The Innovation Ecosystem

for VCAT

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Why an Ecosystem?

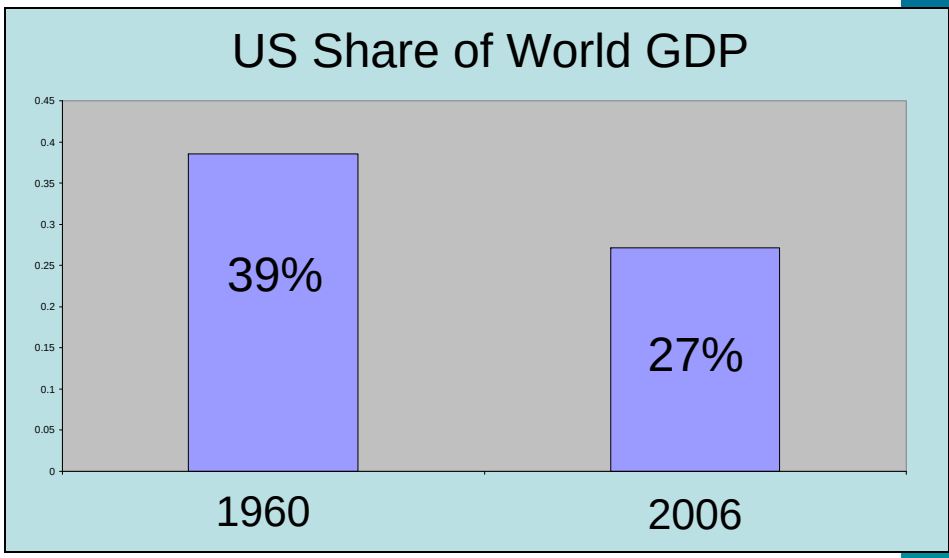
- a functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow
- …forms a complex web of interdependency...

Innovation is important

- "Economists estimate that as much as half of post-World War II economic growth is due to R&D-fueled technological progress"
  - *American Competitiveness Initiative 2006*

- The "ability of U.S. technology corporations to sustain funding of basic research not linked to core corporate activities has been eroded."
  - *Auerswald and Branscomb, "Reflections on Mansfield, Technological Complexity and the 'Golden Age' of US Corporate R&D," 2005*

- Other countries have analyzed U.S. economic success of the last half century
  - Are implementing similar and accelerated approaches
    - Concentrating on weaker points in their innovation systems
    - These efforts are demonstrating success



Participants and Roles in the Innovation Ecosystem

- Governments
  - setting broad policy directions
  - funding basic scientific research;
- Private enterprises and their research institutes
  - contribute to development and other activities that are closer to the market than government
- Universities and related institutions
  - provide key knowledge and skills;
- Bridging institutions
  - act as intermediaries
  - play an important role in closing the gaps among the other actors
- Other organizations, public and private
  - venture capital firms, federal laboratories, and training organizations.

from National Academy of Sciences (2007), Innovation Policies for the 21st Century

The U.S. is strong and among the world leaders

The Global Competitiveness Index*

The GCI, albeit simple in structure, provides a holistic overview of factors that are critical to driving productivity and competitiveness, and groups them into nine pillars:

- ***Institutions***
- ***Infrastructure***
- ***Macroeconomy***
- ***Health and primary education***
- ***Higher education and training***
- ***Market efficiency***
- ***Technological readiness***
- ***Business sophistication***
- ***Innovation***

Rankings 2007-2008 Top Ten

Rank	Country	Score
1	US	5.67
2	Switzerland	5.62
3	Denmark	5.55
4	Sweden	5.54
5	Germany	5.51
6	Finland	5.49
7	Singapore	5.45
8	Japan	5.43
9	UK	5.41
10	Netherlands	5.40

*World Economic Forum, Global Competitiveness Report 2007

BUT

- Other countries have learned, copied, and improved upon the U.S. approach
- U.S. is not maintaining key investments in the innovation infrastructure

What Part Of The Ecosystem To Focus On?

- The *Gathering Storm* and *Falling Off The Flat Earth* and many other reports focus on a few key areas of concern for the U.S.:
  - *Education*
  - ***Investment in R&D***
    - ***Particularly basic research for the physical sciences***

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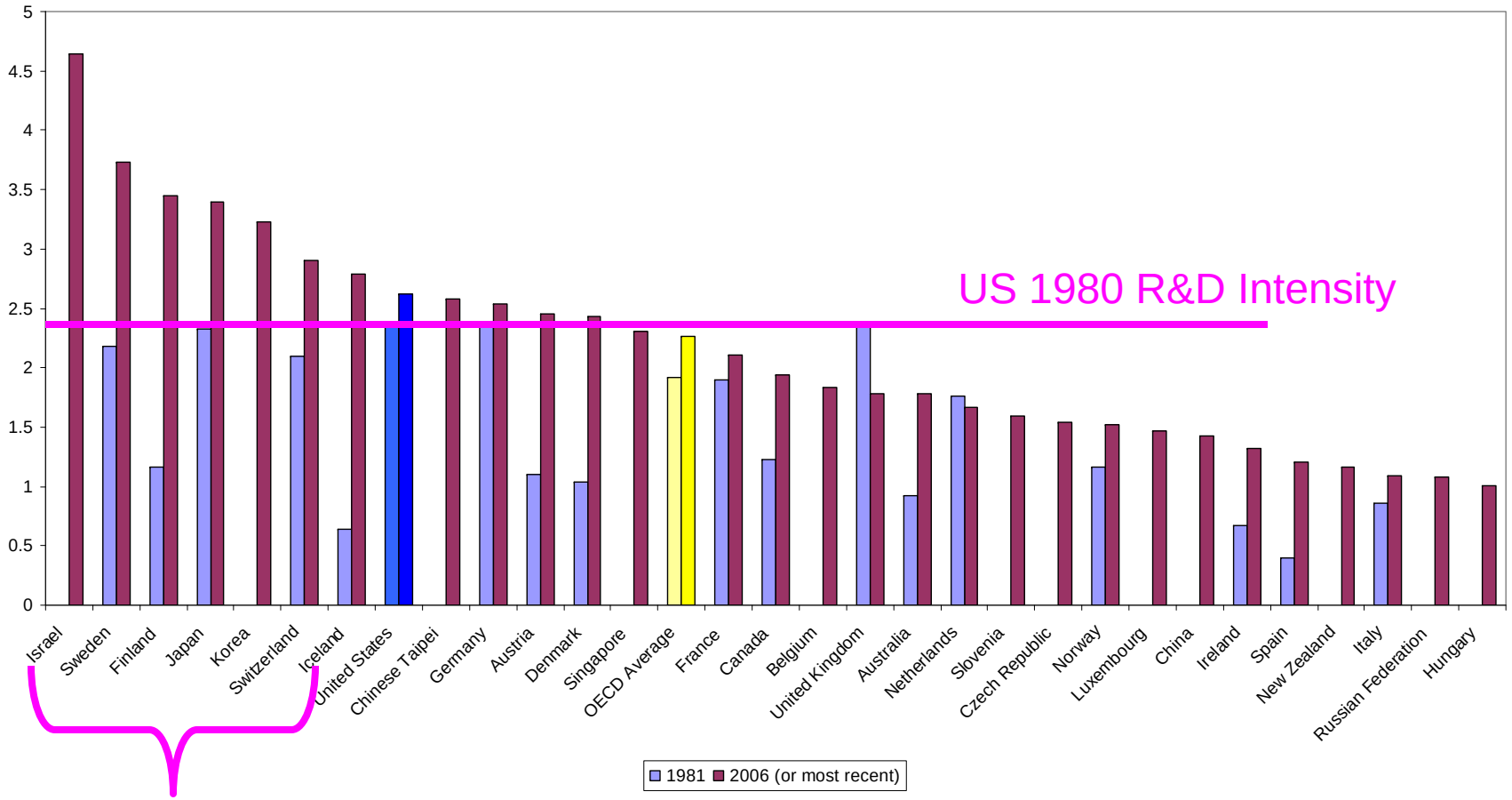
R&D Intensity

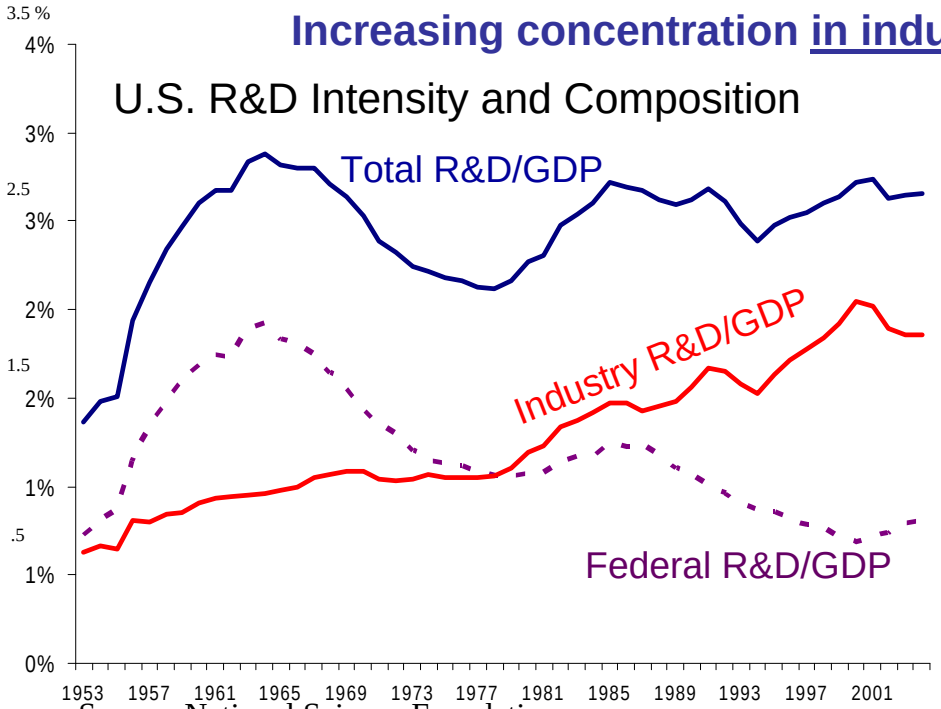
US rank falls from 3rd to 8th



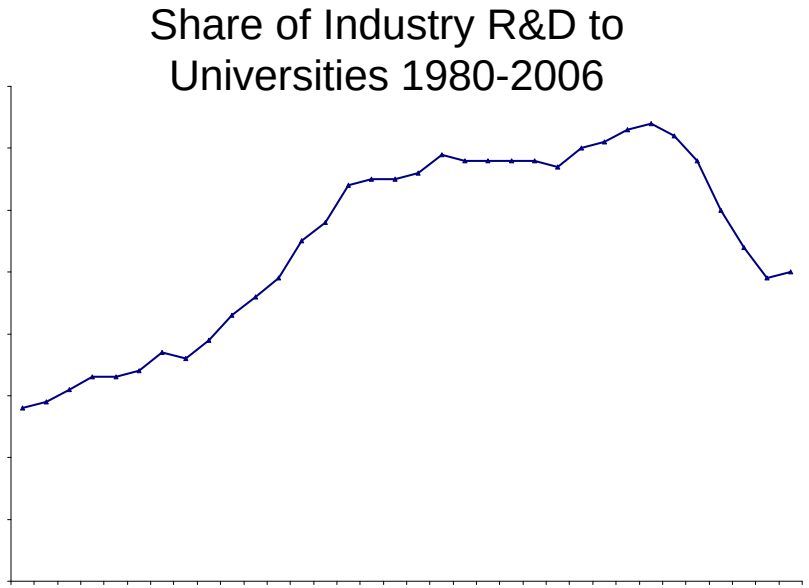
- All of these countries "leap frogged" ahead of US

II. National Trends in R&D Investment

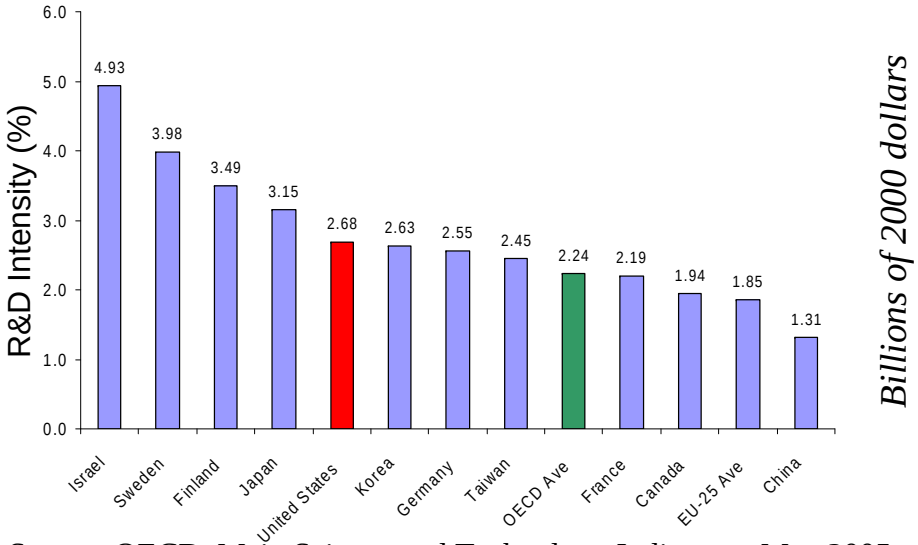
Increasing concentration in industry and on development



Source: National Science Foundation



Source: National Science Foundation



Source: OECD, Main Science and Technology Indicators, May 2005

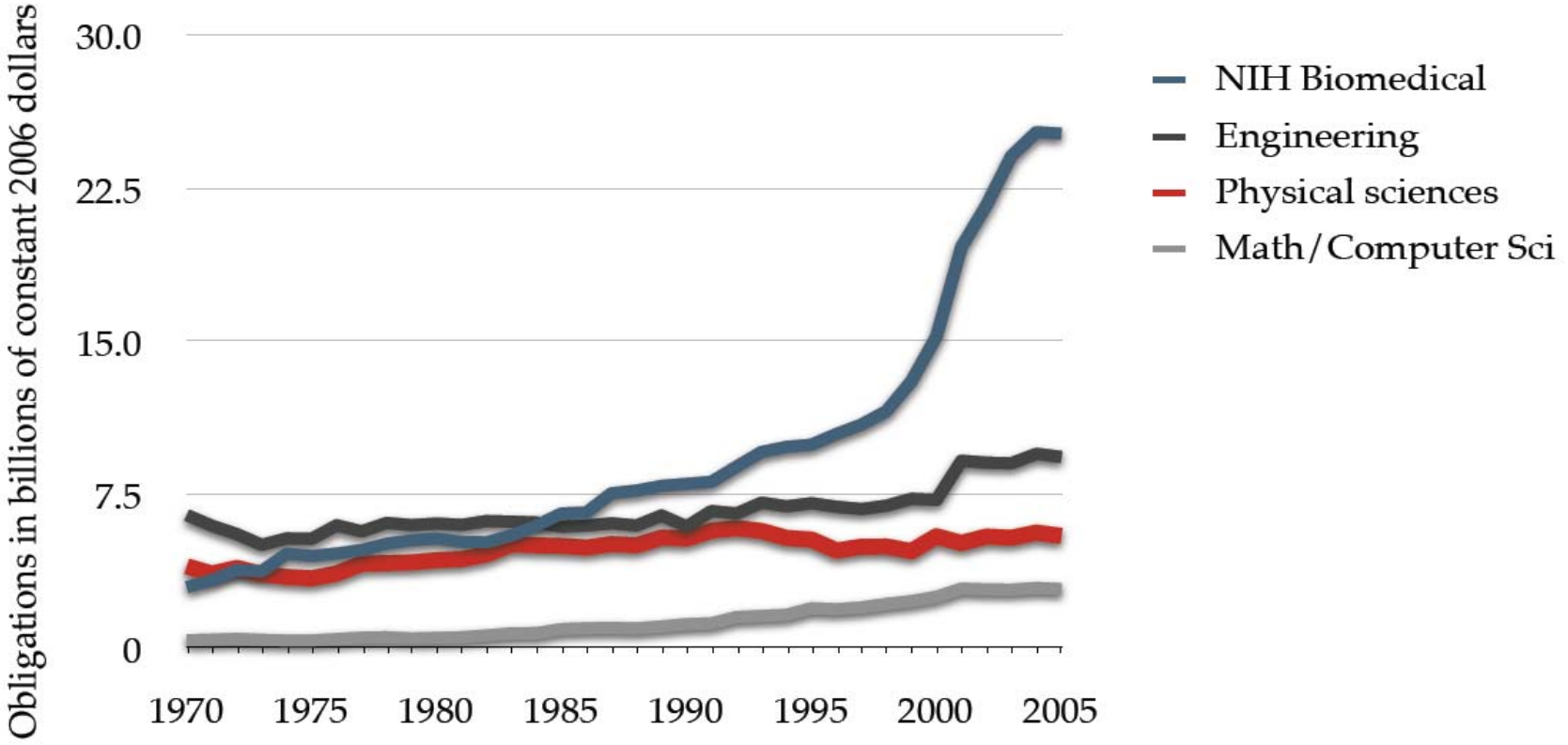
Billions of 2000 dollars

160

Source: National Science Foundation

Why Physical Sciences?

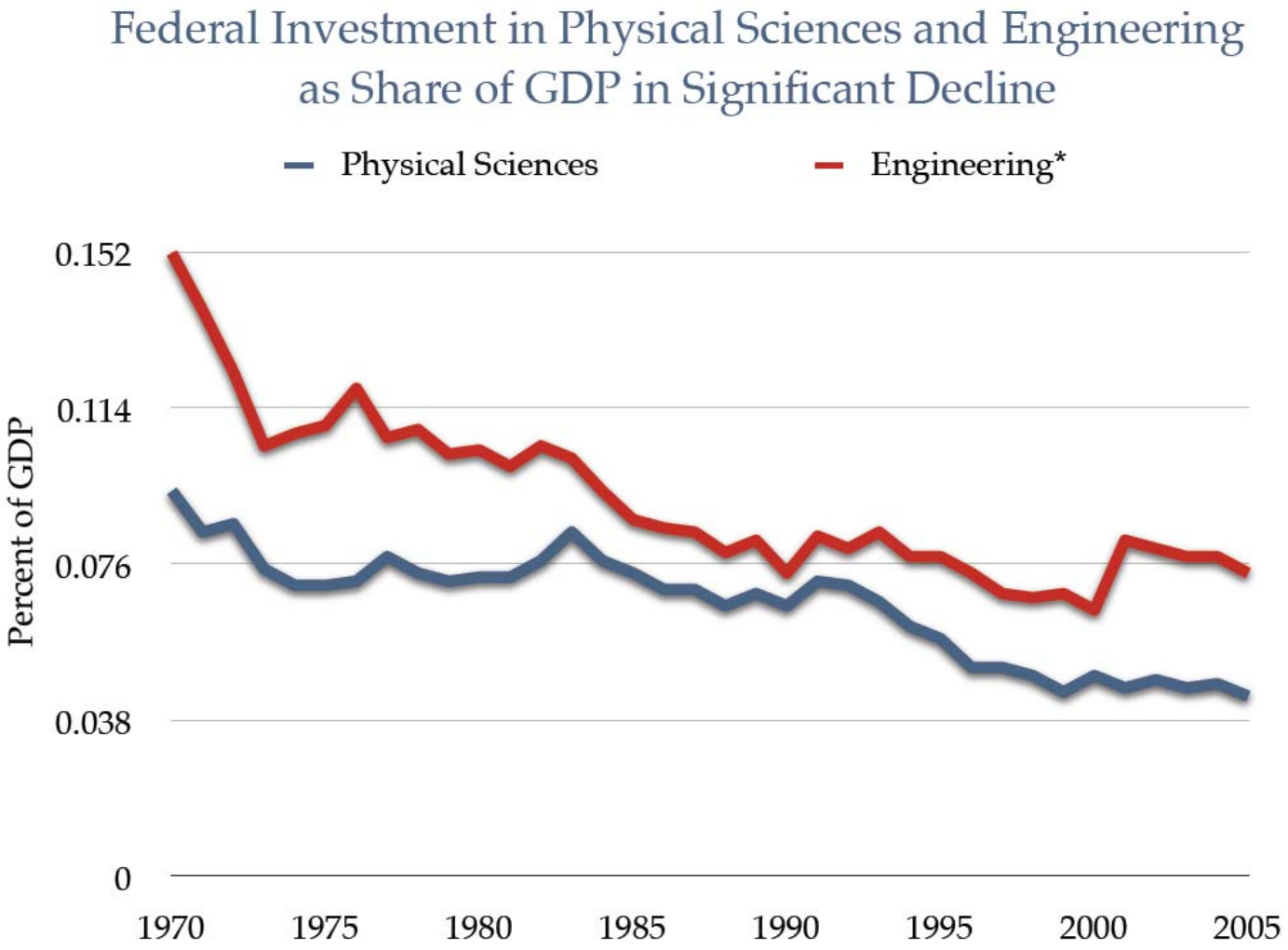
Trends in Federal Research, by Discipline, 1970-2005



* Other includes research not classified. Includes basic research and applied research, excludes development and R&D facilities. Life sciences -- split into NIH support for biomedical research and all other agencies' support for life sciences.
Source: National Science Foundation, *Federal Funds for Research and Development, FY 2003, 2004, 2005, 2006*. FY 2005 and 2006 are preliminary. Constant dollar conversions based on OMB's GDP deflators for FY 2006.

From Task Force on the Future of American Innovation 2006

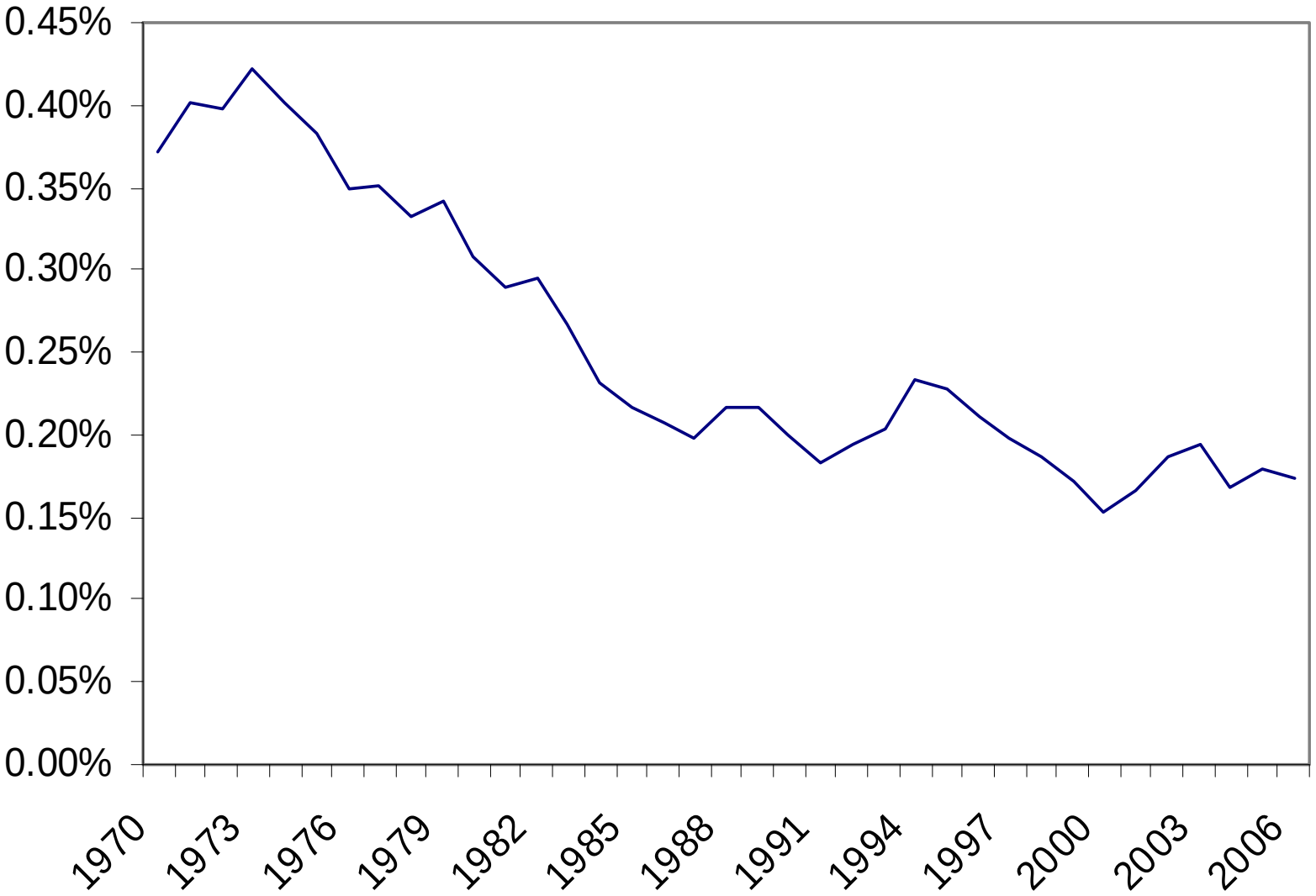
Physical Sciences



*The 2001 jump in engineering is due to reclassification of funding and is therefore artificial.
Source: American Association for the Advancement of Science. http://www.aaas.org/spp/rd/guidisc.htm.
Compiled by the APS Washington Office.

From Task Force on the Future of American Innovation 2006

NIST Laboratory Budget Relative to Industry-Funded R&D



Innovation & Competitiveness

- Complex capabilities, relationships, and interactions lead to innovation
  - Requires the right knowledge in the right place, at the right time, among the right people, with the right resources
  - An innovation “ecosystem”
- Can the Government enable faster/more innovation and help make the US more competitive?
  - What does NIST do to enable innovation?
    - Knowledge creation, transfer and use
  - How does NIST leverage its resources to maximize its impact on innovation.

NIST Mission

- To promote U.S. **innovation** and industrial **competitiveness** by advancing
  - measurement science,
  - standards, and
  - technology

What

How

- in ways that enhance *economic security* and improve our *quality of life*

Why

NIST provides the “innovation infrastructure”

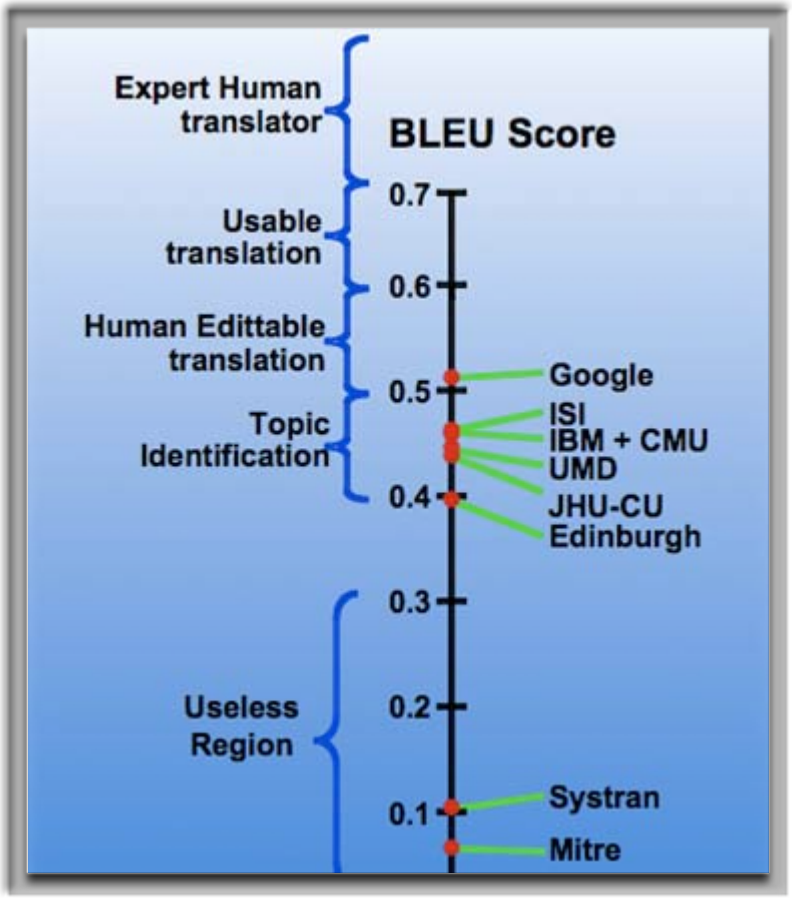
The equivalent of research “roads and bridges” that industry and science need to create, develop, and commercialize new technologies

- Groundbreaking research in measurement science that foster new fields— quantum information, nanotechnology, bioscience
- Better measurement methods to ensure quality
- Performance measures for accurate technology comparisons
- Standards to assure fairness in trade
- Evaluated data for technology development

2005 NIST MT Challenge

Google “comes out of nowhere”, employing massive data-intensive computing to win

Confirms the scalability of a range of algorithms



Examples of NIST Knowledge Transfer Mechanisms

- Collaborations
- ~ 2600 Associates and Facility Users
- 140 CRADAs in FY 07
- Measurement Research
- ~ 2,200 publications per year
- ~ 8,000 attendees at 69 technical workshops/conferences
- Standard Reference Data
- ~ 100 different types
- ~ 6,000 units sold per year
- ~ 130 million data downloads per year
- Standard Reference Materials
- ~ 1,300 products available
- ~ 33,000 units sold per year
- Patents and Inventions
- ~ 40 in FY 07
- Baldrige National Quality Program
  - 67 Award recipients (71 Awards)
  - 1,139 Baldrige Award applications
- Manufacturing Extension Partnership
  - ~28,000 Clients

- Calibration Tests
- ~ 24,000 tests per year
- Laboratory Accreditation
- ~ 800 accreditations of testing and calibrations laboratories per year
- Standards Committees
- ~ 400 NIST staff serving on 1,000 national and international standards committees
- Other Agency R&D
- > 300 Agreements with 80 Fed. Agencies
- $111M received in FY 2007

NIST Services* in 2007 (over 97,000)

(Includes SRM and SRD sales, calibrations, NVLAP accreditations, conference and workshop participants, citations, NCNR research participants, ATP projects, and MEP assistance)

* Only partial listing of services ... For example time dissemination not included.

People: NIST Staff and Partners in 2007 (over 12,000)

(Includes NIST Employees, Associates, Facility Users, MEP Field Staff, Co-authors, NQP Examiners and Others, NVLAP Assessors, and Weights and Measures Officials)

NIST's Technology Toolkit

- Knowledge Creation, Transfer, Use
  - Many highly effective products and services
    - Last 19 economic impact studies show an average 44:1 return on investment
  - Many approaches for partnering
    - Heavily leveraged
    - Highly productive
- Constantly looking for improving and adding to existing approaches
  - New in the last two years include:
    - Joint Quantum Institute
    - Technology Innovation Program
    - Nanoelectronics Research Initiative Model
    - MEP Next Generation

This VCAT Meeting

- Session I: Enhancing Use Inspired Basic Research – NIST Working with Academia, Industry, and Other Agencies
- Laboratory Tours
  - Using Neutrons to Study and Help Design Novel, Advanced Materials for Industrial and Scientific Use
  - Radiation Measurements for Health, Safety & Homeland Security
- Session II: Deploying Technology and Operational Excellence
- Session III: Responding to Standards' Needs in a Dynamic World

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